Aqua America

# Kankakee & University Park Water Systems
## Kankakee County, Illinois
### Hydraulic Water Analysis Report –

**PREPARED FOR**

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# I. EXISTING SYSTEMS – Kankakee & University Park

## a. Network Model Settings

The hydraulic model was built and analyzed based on:

1. The hydraulic model is set to run as both a Steady-State and an EPS (extended period simulation) calculation model. The EPS analysis was conducted under a 72 hour run for operational purposes and a 744 hour run for water age and quality.
2. The hydraulic model contains two distinct and separate water systems, one being Kankakee and one being University Park (UP).
3. System diurnal based on AWWA standard system and adjusted to meet actual system peaks.
4. Pipe lengths, layout & diameters were provided by Aqua America.
5. The Hydraulic Model contains 8,285 pipes at a total length of 504 miles (systems combined).
6. The Hydraulic Model contains 7,157 junctions (systems combined).
7. The Hazen-Williams C-Factor for all existing pipe range from 20 to 110. All proposed pipe in the model has been given a C-factor of 120.
8. Elevations are based on USGS datum.
9. Elevation ranges from a low 600’ located at the Kankakee Water Treatment Plant (Kankakee) to a high 800’ located on Roosevelt Street (University Park).

## b. Network Model Assumptions

The proposed pipeline scenario was calculated using the following assumptions:

1. The proposed pipeline size has been analyzed as a free body, comparing a 24 inch to a 30 inch ductile iron pipe.
2. All required water reaches the Diversitech Tank under all conditions.
3. The terminus of the pipeline is the ground level tank at UP Well 3.
4. Growth of UP load through 2040 at a 1% annual growth rate was the consideration.
5. New pipeline is DIP to be able to raise the pressure high and take advantage of pipeline capacity.

# II. PROPOSED SCENARIOS

## A. Scenario P1 – 24" Ductile Iron Pipe Connecting Kankakee to University Park

**Concept:**

To allow the Kankakee Water Treatment Plant to supply the University Park water system, a connection between the two systems is required. These two systems are approximately 14 to 17 miles in distance from each other with relatively one hundred feet difference in elevation.

Scenarios P1 & P2 compare the pros and cons of installing either a 24 inch or 30 inch ductile iron pipe. Both analyses utilize the existing pumps at the Grant Park/Diversatech station in Kankakee with no other proposed changes involved. The average day demand (ADD) of University Park in 2013 is 1.30 MGD, a projected growth of 1% annually is considered in the analysis.

**Results:**

1. With a 24-inch pipeline, the average day demand (AAD) needs are met up to and through Year 2040 with two (2) existing Grant pumps running in parallel. If we replace the Grant pumps to discharge at 250 psig, then we can send 6.5 MGD up the 24" pipeline, with the limiting factors being both the 250 psig discharge pressure and the 20" velocity of 5 fps.

2. With a 24-inch pipeline, the peak day (ADPM) 2013 is not met by running all three (3) Grant pumps. The booster station currently dedicated to Grant Park is next to a booster station used to feed Manteno. The two stations are able to backup or replace each other. By turning off valves, the current Manteno booster station's larger pumps can be dedicated to feeding Grant Park and UP through the 20" main, while the current Grant Park pumps would be dedicated to supplying Manteno.

3. From a "textbook" standpoint, the 24" pipeline at 5 fps has a 10 MGD capacity. In order to move those kinds of flows, additional facilities would be needed: either the existing 3 miles of 20" needs to be paralleled to eliminate the bottleneck, or a 3 mile extension out of the Manteno grid to the pipeline along with a companion booster station must be installed. Either of these actions "circumvents" the 20" bottleneck and allows what is essentially a 24" size "all the way" to provide 10 MGD. In reality, however, operating a 17 mile pipeline at a 5 fps level can be a challenge in terms of surge and transient waves that are difficult to control despite BMPs. Therefore, a more realistic capacity is based on 3 fps in the 24", which correlates to 6.5 MGD. (Grant Booster disch = 157 psig)

**B. Scenario P2 – 30" Ductile Iron Pipe Connecting Kankakee to University Park**

**Concept:**

To allow the Kankakee Water Treatment Plant to supply the University Park water system, a connection between the two systems is required. These two systems are approximately 14 to 17 miles in distance from each other with relatively one hundred feet difference in elevation.

Scenarios P1 & P2 compare the pros and cons of installing either a 24 inch or 30 inch ductile iron pipe. Both analyses utilize the existing pumps at the Grant Park/Diversatech station in Kankakee with no other proposed changes involved. The average day demand (ADD) of University Park in 2013 is 1.30 MGD, a projected growth of 1% annually is considered in the analysis.

**Results:**

1. With a 30-inch pipeline, the average day demand (AAD) needs are also met through Year 2040 with two (2) Grant pumps running in parallel – similar to the 24" result. If we replace the Grant pumps to discharge at 250 psig, then we can send 6.5 MGD up the 30" pipeline. The limiting factors are the 250 psig discharge pressure and the 20" velocity of 5 fps.

2. With a 30-inch pipeline, the peak day (ADPM), is not met by running all three (3) Grant pumps running in parallel. As in the 24" pipeline discussion, the two booster stations can be valved to change the areas that are fed by the respective boosters. This allows the larger pumps to be used to feed the main to Grant Park and UP, which will meet the projected peak day.

3. From a textbook standpoint, the 30" pipeline at 5 fps has a 16 MGD capacity. In order to move those kinds of flows, either the existing 3 miles of 20" needs to be paralleled to eliminate the bottleneck, or a 3 mile extension out of the Manteno grid to the pipeline along with another booster station must be installed. Either of these actions "circumvents" the 20" bottleneck and renders what is essentially a 30" pipeline "all the way" to provide 16 MGD. However, operating a 15-20 mile pipeline at a 5 fps level can be a challenge in terms of surge and transient pipe failures that are difficult to control despite BMPs. A more realistic capacity is based on 3 fps in the 30" which correlates to 9.6 MGD. (Grant Booster disch = 140 psig)

## C. Recommendations

1. The recommendation is that 3 fps be the governing boundary condition to operate such a long pipeline. With a 24" size, the capacity of that line is realistically 6.5 MGD.

2. In terms of just serving University Park using conservative annual growth numbers and relegating (capacity = 6.5 MGD) can meet UP 2040 peak day needs of 4.10 MGD.

3. A 30" size realistically allows Aqua to provide close to 10 MGD reliably.

**University Park Projected Demand Growth**

**UP @ 1.0 % Growth Yearly (MGD Shown)**

| Year | ADAM | ADPM | ADPM w Peaker Plants (1300gpm) |
|---|---|---|---|
| 2013 | 1.30 | 1.70 | 3.57 |
| 2014 | 1.31 | 1.72 | 3.59 |
| **2015** | **1.33** | **1.73** | **3.61** |
| 2016 | 1.34 | 1.75 | 3.62 |
| 2017 | 1.35 | 1.77 | 3.64 |
| 2018 | 1.37 | 1.79 | 3.66 |
| 2019 | 1.38 | 1.80 | 3.68 |
| **2020** | **1.39** | **1.82** | **3.69** |
| 2021 | 1.41 | 1.84 | 3.71 |
| 2022 | 1.42 | 1.86 | 3.73 |
| 2023 | 1.44 | 1.88 | 3.75 |
| 2024 | 1.45 | 1.90 | 3.77 |
| **2025** | **1.46** | **1.92** | **3.79** |
| 2026 | 1.48 | 1.93 | 3.81 |
| 2027 | 1.49 | 1.95 | 3.83 |
| 2028 | 1.51 | 1.97 | 3.85 |
| 2029 | 1.52 | 1.99 | 3.87 |
| **2030** | **1.54** | **2.01** | **3.89** |
| 2031 | 1.55 | 2.03 | 3.91 |
| 2032 | 1.57 | 2.05 | 3.93 |
| 2033 | 1.59 | 2.07 | 3.95 |
| 2034 | 1.60 | 2.10 | 3.97 |
| **2035** | **1.62** | **2.12** | **3.99** |
| 2036 | 1.63 | 2.14 | 4.01 |
| 2037 | 1.65 | 2.16 | 4.03 |
| 2038 | 1.67 | 2.18 | 4.05 |
| 2039 | 1.68 | 2.20 | 4.07 |
| **2040** | **1.70** | **2.22** | **4.10** |